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ABSTRACT

"A Computer for Every Teacher" was a project of the Indiana Department of Education to provide each teacher and administrator in four schools with a computer and printer for personal and professional use. This equipment was accompanied by software and realistic amounts of training. Its focus was to improve teacher productivity and to enhance teacher professionalism with the long-range goal of improving student performance. This evaluation study was conducted two years into the project. In 1992, researchers conducted site visits to interview participants, gather work samples, gather diary forms detailing computer use, and administer a follow-up questionnaire to be compared with a baseline study completed in 1990. Three kinds of outcomes on the schools and on the individuals were found: productivity, professionalism, and empowerment. A list of issues and lessons to be considered for future assessments is included, as well as recommendations for continuing the use of technology in the participating schools and developing similar projects in other schools. Included in the appendices are the two questionnaires and the diary form. (JLB)

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A COMPUTER FOR EVERY Teacher

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Productivity, Professionalism, and Empowerment:
Given a Computer for Every Teacher

by
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October, 1992

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Productivity, Professionalism, and Empowerment: Given A Computer for Every Teacher

Executive Summary

A Computer for Every Teacher was a project of the Indiana Department of Education to provide each teacher and administrator in four schools with a computer and printer for their personal, professional use. This equipment was accompanied by software and realistic amounts of training. Two years after the project started, evaluators made site visits, conducted interviews, collected use diaries, and provided questionnaires to the recipients of the technology. The evaluation was undertaken to explore how teachers and administrators were making use of their computers and to identify the impacts of these efforts.

The four small schools — three secondary schools in rural locations and one elementary school in a suburb — demonstrated common outcomes and are discussed as a group. The researchers found three kinds of outcomes on the schools and on the individuals who worked in them: productivity, professionalism, and empowerment. Briefly, they are as follows:

- Teachers and administrators reported substantial improvements in their productivity, primarily in completing administrative and management tasks. Teachers recounted spending the same amount of time on class preparation and administration, but accomplished more in that period. Gradebook software contributed greatly to that change. As a corollary, in classes where frequent quizzes and tests were given, teachers noted that more frequent feedback about grades resulted in improved motivation and achievement. The electronic gradebook made it possible to update grades daily and thus permitted more information to the students about where they stood and what they had to accomplish to achieve a higher grade.

- The availability of computers and printers tended to improve the quality of materials prepared by teachers and administrators. Class handouts, tests, flyers, letters to parents were prepared in a more professional manner and reflected well on the school. Moreover, teachers now perceived themselves as more competent, given their knowledge and application of the computer to accomplish professional work. Some teachers in each school became "experts" on particular programs or aspects of software (such as mailmerge) and gained the respect of colleagues, who often turned to them for help. The role change from teacher to student, as they were learning about the computer, also led several teachers to reconsider their instructional approach, curriculum, and pedagogy.

• Learning to become proficient on the computer was a great equalizer among the faculty and between faculty and students. Teachers now felt as comfortable and proficient with computers as their students. They were secure suggesting appropriate computer applications to their students and willing to learn from them as well. The staff of each school reported a sense of growth and collegiality that emerged from the process of learning to use computers together. They described pride in their school for meeting the technology challenge and becoming leaders in the use of computers in education.

These positive outcomes were not accomplished without surmounting barriers, cajoling reluctant participants, and overcoming inappropriate training. Among the lessons learned are:

√ Leadership, in the form of a school champion for the project and strong support from top administrators — including the full and willing participation of the principal in the program — is important.

√ For a school, the choice of a single platform makes implementation easier and reduces the cost of training and software.

√ Staff development is central to success. Training should be distributed over the course of the year, and in-house trainers be considered when possible. Having a staff expert in the building provides long-lasting benefits.

√ This project required a financial match for the hardware. Local investment is a powerful and valued part of the change process; it should be part of future efforts.

√ Requiring everyone on the staff to participate contributes to the project's success. Everyone means teachers, administrators, and support staff, all working together on the same tasks of mastering computers and software.

√ Group solidarity contributes to motivation and improving collegial relationships among faculty, most of whom don't talk with one another normally. Make certain that many of the training activities involve them in large and small groups.

The report provides a series of recommendations for continuing the use of technology in the participating schools and in developing similar projects in other schools throughout the state.

This research has shown that *A Computer for Every Teacher* was successful in improving the productivity and performance of teachers and administrators. It is worth replicating wherever and whenever the resources are available.

Acknowledgements

We wish to thank the teachers and administrative staff at the four participating schools for their willingness to participate in this evaluation. While some were not excited about getting a computer, and some were not delighted to complete the forms and spend time being interviewed, the overall enthusiasm and level of accomplishment was rewarding to see. In each school, teachers and administrators passionately showed the evaluators samples of their computer-based work — before and after examples and products that demonstrated their skill. And with a pride that would match the winners of blue ribbons at the state fair.

We also wish to thank the four site project directors, without whom the project would not have achieved the powerful results it did. Roz Eiler, Gail Luedtke, Cheryl Mueller, and Sister Rebecca Abel have our gratitude. Their assistance not only made their schools successful, but they also facilitated much of the evaluation effort by their help in scheduling interviews, distributing questionnaires and diary forms, and cajoling their colleagues to respond in a timely fashion.

And we certainly thank Mary Jo Erdberg of the Indiana Department of Education for her assistance, guidance, and thoughtful advice in the conduct of this evaluation. Her efforts in the design of *A Computer for Every Teacher* and in its continued support are commendable.

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Productivity, Professionalism, and Empowerment: Given a Computer for Every Teacher

I. Introduction

Powerful changes in education can come in many ways. Substantive and long-lasting changes in teachers' attitudes and behavior are powerful mechanisms that help improve teaching and learning in the classroom. The project *A Computer for Every Teacher* is one effort by the Indiana Department of Education to stimulate such changes in schools throughout the state. It combines the need to improve schools with a strongly-supported interest in using technology to achieve important educational goals. Its focus is to improve teacher productivity and enhance teacher professionalism with the long-range goal of improving student performance. It is based on the belief that teachers are information-age professionals who should be using contemporary technology to accomplish their work. By using such technology, their personal productivity will improve and, consequently, so will their instructional efforts and impacts in the classroom.

Four small schools — three secondary schools in rural locations and one small elementary school in a suburban area — received grants to acquire computers for the personal use of all instructional and administrative staff and to provide training to the staff on basic sets of computer software. In order to apply for a grant, every staff member had to agree to participate. *A Computer for Every Teacher* was just that — all had to participate and in return received a computer and printer for their use at home or in school, wherever they chose to keep it. This study is concerned with how participants used (or did not use) the computers provided by the project and with the impacts of the availability and use of this technology.

The computer project began in the summer of 1990; this evaluation study was conducted in the spring of 1992, almost two years into the project.

Fortuitously, we administered a preprogram questionnaire at the very beginning of the effort and thus obtained information from the earliest point of the project. The data we report here combine questionnaire reports with site visit interviews, diary information, and extensive discussions with the participating site leaders. The conclusions and interpretations are the responsibility of the authors.

- **Background of the project**

The Indiana Department of Education has been a leader in innovative projects to explore the power and productivity of technology in education. Historically, from radio to television to computers, Indiana has provided leadership and support for schools willing to innovate and share their knowledge with others. *A Computer for Every Teacher* was designed and implemented by the Indiana Department of Education as part of its school improvement and technology program with expectations that it, too, would provide an innovative approach to school change.

Designed in early 1990, *A Computer for Every Teacher* required a proposal from interested schools, and assurances that every teacher in the school had agreed to participate should the grant be awarded. More than one hundred proposals were received and, following a selection process and site visits to potential grant recipients by a member of the Indiana Department of Education staff, four grants were awarded in the summer of 1990. As a result, four schools purchased 133 computers for teachers and administrators. Staff training began almost immediately at most of the locations. (Note: nine additional computers were purchased by the sites for new staff with second-year or school/district funds. The number of participants for years one and two, combined, was 147 — 142 in year one with five teachers replaced over two years.)

- **Methodology and procedures**

In anticipation of support for this research, we conducted a baseline study of the personal and professional uses of computers by school personnel at the winning sites in the fall of 1990. This survey also sought to obtain the participants' expectations for the changes that might be brought about by the availability of a computer for personal and professional use at home and in school. This baseline questionnaire was completed by one hundred percent of the participating teachers and administrators.

In the spring of 1992, researchers made site visits to each school and conducted interviews with most of the instructional and administrative staff. We also conducted extensive interviews with the project coordinators at each location. At that time, we were provided with numerous work samples from teachers in all subject areas and grade levels. At each school, we left copies of diary forms for each teacher to complete for four randomly selected days over a two-week period in May. A follow-up questionnaire was distributed to all participating school staff by the project coordinators prior to the end of the school year. The high return rate (88% for the second survey) is indicative of the general enthusiasm for the project as well as of the consistent and continual efforts of the project coordinators at each site.

In addition, we brought together the four school-site coordinators for a debriefing session in late June, 1992. Their discussions of the barriers to full and productive use of the computers, the successes among their colleagues, their perceptions of the implementation effort, and their thoughtful reactions to the impact brought about by the program were all useful additions to the other qualitative and quantitative data collected in this research effort.

In reporting the information collected for this research project, we will provide summary data across all sites. A review of the entire set of data

indicates that there are few and non-meaningful differences between the analysis of only the three secondary schools and that of the combined elementary and three high schools. When dramatic exceptions occur, they will be noted, but most of the data will reflect the set of teachers and administrators aggregated over the four schools. Due to rounding errors, some of the data descriptions will total slightly more or less than 100%.

- **Participants**

Our sample includes all of the school instructional and administrative staff at the schools for the questionnaire preceding the implementation of the *A Computer for Every Teacher* project and returns of 88 percent for the questionnaire administered at the end of the second year of use. Only 5 (3%) participants returned questionnaires in year two only, which matches the addition of about one new teacher per school over the two years of the project.

Of the school staff who received computers and printers from the project, 124 (84%) were classroom teachers, 7 (5%) were counselors, 10 (7%) were administrators, and the remaining 6 (4%) were librarians, computer/media specialists or other support staff. Given the nature and locations of the schools (the three secondary schools are in small towns or rural areas), there are proportionately higher numbers of vocational and agricultural education staff (23 people, or 17 percent of the total instructional staff) than are found in larger communities in Indiana. With only four small schools participating, the project cannot claim to represent the range of schools in the state. Nevertheless, the consistency of the project replications (the same project was implemented in each of the schools independently), and the consistency of the interview and diary data, indicate that the conclusions reported here are valid and reliable estimates of what can happen in other schools.

The instructional staff appears to be representative of schools throughout the state. Most (82%) had a master's degree or an additional degree beyond the BA; instructors had been teaching for an average of 15 years, ranging from several newly-minted teachers to a few who had been teaching for more than 30 years. Many had been in the same school for more than 10 years.

To give an idea of the range of participants taking part in this project, the analysis of the instructional staff at the start of the project included:

Table 1
Distribution of Teachers by Subject Taught

Mathematics/science	19%
Elementary generalists	17
Language arts/foreign languages	17
Vo-ed/ag	16
Fine arts	10
Social studies	8
PE/health	6
Special ed	5
Computer	1
Gifted/Talented	1
Number of teachers (124)	100%

Prior to the start of this project, most of the teachers and administrators (77%) had some experience using a computer, in school or at home, and that experience ranged up to 10 years, with an average of 3 years of prior computer use. Four out of 10 of the participants owned a computer at home and most of them used it for professional work of some sort. Given the emphasis on using technology for education in Indiana, it is not surprising that two-thirds of the teachers and administrators had received some in-service training on using computers, and most of that was provided by the statewide computer literacy program run by the Department of Education. Approximately one-fourth of

staff members had taken an additional computer course or staff development program on their own. Many of the teachers, especially those in vocational/technical areas, had taken computer courses in college and many of the younger teachers had received some modest computer training during their college preparation. Before the project began, 31 percent of the participants reported having taken an undergraduate class in computers; another 18 percent had had a graduate class. Most of the latter reported that they had taken the introductory computer class given in their master's degree program. On the other hand, one out of five teachers and administrators had no formal training on computers, either academic or in-service.

Thus, the participants reflected the kinds of experienced teachers and administrators found in schools throughout Indiana, with modest histories of using computers — but with a definite interest in using them for instructional and professional purposes. Instructional applications were of greater interest than were personal professional opportunities for many of the teachers. In each of the schools there was an existing computer education program that provided students with opportunities to use computers for instruction or for the preparation of reports. Some of the schools had laboratories with a computer teacher; others had computers for students to use on the school newspaper, for the vocational/agricultural education program, or in the business education department. Thus, in the participating schools, students, even more than teachers, had experience using technology for their schoolwork.

II. Implementation

The project began during the summer before the start of the 1990 school year. One school began its work before the formal start of school, while others waited until the staff development period prior to fall semester to distribute the equipment and to begin staff development activities. Variations among the schools were based primarily on the interests, preferences, and roles of the site coordinators. These differences were displayed in a variety of ways.

- **Hardware selection**

While the Indiana Department of Education did not specify a brand or model of computer for purchase, there were some demands for fiscal restraint; neither the most powerful computers nor the most expensive models on the market were selected. Moreover, the schools were able to select one or more kinds of computers for their staff. One school involved its staff in the choice, and reached agreement on a single computer system for all teachers and administrators. A single computer was also chosen by the site coordinator in another school, but without the participation of staff. In another school, teachers and administrators could select from between MS-DOS and Macintosh computers, but the coordinator stressed acquisition of IBM-compatible personal computers, expecting a common administrative computer system for the school. In the other, staff could choose from among MS-DOS, Macintosh, and Apple IIGS systems. Three of the four schools ended up with primarily Apple Macintosh systems (one included a few MS-DOS and Apple IIGS computers). The fourth school had a truly mixed system with one-third of the teachers having Macintosh computers and the remainder MS-DOS computers.

When people had a choice of computers, it was often influenced by their spouse or young children at home. These were not always informed choices,

and the recommendation of the school's computer leader was paramount in many people's eyes.

- **Training and staff participation**

The grants from the Indiana Department of Education provided for a standard set of training during the first year, focusing on the basic computer functions available in the software each school selected. Included in the training were basic elements of word processing, graphics, spreadsheets and data bases. In addition, most of the teachers were taught how to use a gradebook program. All of the training was paid for by the Department of Education, with the sites using approved consulting and training organizations. Schools could choose their trainers and, especially during the second year, used members of their own staff as well as external consulting groups. Each of the participating teachers and administrators was required to attend the training sessions during the first year, and the coordinators went to great lengths to insure that the schedule met the needs of the school. Make-up sessions were scheduled when needed.

The most difficult staff members to schedule for staff development were often the coaches and physical education teachers. They had extracurricular responsibilities at the end of the regular school day and were not easily deterred from those duties. Each of the secondary schools solved the problem in its own way. One school scheduled full days of staff development time, so that everyone was available. Another school, located in a traditional German Catholic area, had historically retained Wednesday afternoon as a free time for religious activity, so that no athletic events could be scheduled. Thus, it was a time available for staff development, as well.

Not everyone was an enthusiastic participant. Many of the teachers and administrators who had not used computers for their own work — including

many who had assigned computer activities to their students but had not actually used the computer themselves — were somewhat reluctant to demonstrate their ignorance before their colleagues. Having a computer to take home and use privately was sufficient encouragement for most. In addition, some "handholding" and one-on-one sessions were conducted by the computer coordinators and project coordinators in each of the schools.

Formal sign-on to get the grant insured that all teachers and all administrators participated, even those without any interest in using computers, because the latter wanted to help others and/or they submitted to peer pressure. Since signing up for the project meant a commitment, they had to go forward with their participation in the project when the grant was received. This formal, public commitment also gave leverage to the coordinators when it was time to train the school staff. While there was some reluctance — and training was not universally successful — almost all teachers and administrators have learned how to accomplish some basic functions on the computer.

In the second year, Technology Associates, as well as local and regional consultants, were employed by the schools to provide additional staff development programs. While this effort was not initially planned as part of the grant, it was deemed necessary by the school site coordinators and supported, in turn, by the Department.

During the initial year of the program, some basic skills had been learned, especially in word processing and in using a computer gradebook. However, everyone recognized the need to keep the staff moving ahead; in fact, teachers were surveyed or initiated a request for specific training. So, for the second year, training focused on further development of specific computer skills and used trainers selected by the schools themselves, including internal trainers.

These internal trainers were regarded favorably by many people in the school, since they were known and available for additional help during the school day, even after the formal training took place.

Few teachers or administrators attended external training or courses at local colleges and universities; the training provided at the school site was deemed sufficient, or at least provided teachers with the opportunity to learn what they wanted to learn. Many of the building administrators chose not to seek further staff development during the second year, when it was "less mandatory."

Nevertheless, the time invested in staff development provided payoffs within the first few weeks of the project. Teachers invested significant amounts of their own time to learn the software after the initial in-service programs. Much of the effort made by teachers was to develop individual skills that were only introduced at training sessions. These skills, then, were applied by the teachers when doing productive professional work in school and at home.

- **Administrator support**

Administrators and administrative staff at each of the schools were quite supportive of the project, especially since it provided a significant amount of computer power on the desks of teachers and others in the building. In some of the schools, a high-level administrator served as the cheerleader and advocate — and sometimes a proficient and model user — of the efforts of the site coordinator. The administrators and the teaching staff reflected the interest and abilities of the school as a whole. There were some skilled and proficient advocates, some reluctant but willing learners, and some recalcitrant diehards.

The support from above did not mean that all administrators became as proficient on the computer as the teachers. Principals were the least likely to

master many pieces of software and usually had to seek support from other staff to accomplish even modest tasks. Nevertheless, principals were enthusiastic about the development of skills among their faculty members and about the impact of the computer grant on their school. Other administrators, however, often became quite skilled at using certain programs. Guidance counselors, particularly, had both the needs and the support to build and maintain student records on their computers. They were often using the most sophisticated programs and in the most complex fashion.

The grant required that the school administration participate in the project with the teachers. Their presence and visibility helped underscore the importance of the project to the entire staff and demonstrated support for the coordinator. The participation of all professional staff was central to the success of the project at each site.

- **Community involvement**

Two of the participating schools had community programs to teach adults about computers. In the context of community relations, they brought adults into the school and, at a nominal rate, taught them about using computers. This meant that student labs were opened in the evenings, and skilled teachers, many of whom had learned from this program, helped teach adults in the labs. In many instances, this effort helped parents understand what their children were doing in school and garnered support for the computer program.

III. Utilization

In-school uses of computers varied by function, by subject specialization and department, and by the skill level attained by each individual user. Common elements, across schools and across departments, were the use of gradebook and word processing software. We found only a few instances of specialized software being used in the schools. Administrators, especially guidance counselors, used different software — or used the same software differently — from that used by other school faculty.

- **Staff attitudes**

The teachers started with very high expectations. (On a 7-point scale used in the initial survey, staff could not improve much, because there was little room to move!) However, from the interviews conducted at the school sites, we found that teachers and administrators were dissatisfied after the first year, because they couldn't do all they had hoped. Their high expectations collided with the need for time and effort to learn what they wanted to learn. The learning process was more demanding than they had anticipated. While their expectations may have exceeded what could be realistically accomplished — given the amount of time and training — many teachers still felt that they should have accomplished more. Among those we interviewed, there were a only few teachers who recognized how far they had come. They knew they had spent the time productively, in school and at home, to develop their skills.

There was a major attitude change from before the program began to the end of the second year. We analyzed the set of attitude questions on the questionnaires completed by teachers prior to the start of the *A Computer for Every Teacher* program and at the end of the second year of the project. From the set of preprogram data, we identified three additional attitudinal factors.

These three factors can be defined as computer phobia, educational change, and efficiency/productivity.

From the data collected at the end of year two, the computer phobia factor stayed the same, but the other two factors merged. We believe that through the program, actions and expectations melded. People recognized what they were doing with computers and changed their attitudes about what they thought computers could do to affect education. Computers improved their personal productivity and helped them with their work; as their upgraded work habits and accomplishments made a difference to them, they began to believe computers would make a difference to others. They also received a dose of reality, recognizing that changes do not come easily, and that hard work was needed to become experts on the software they had initially chosen to learn.

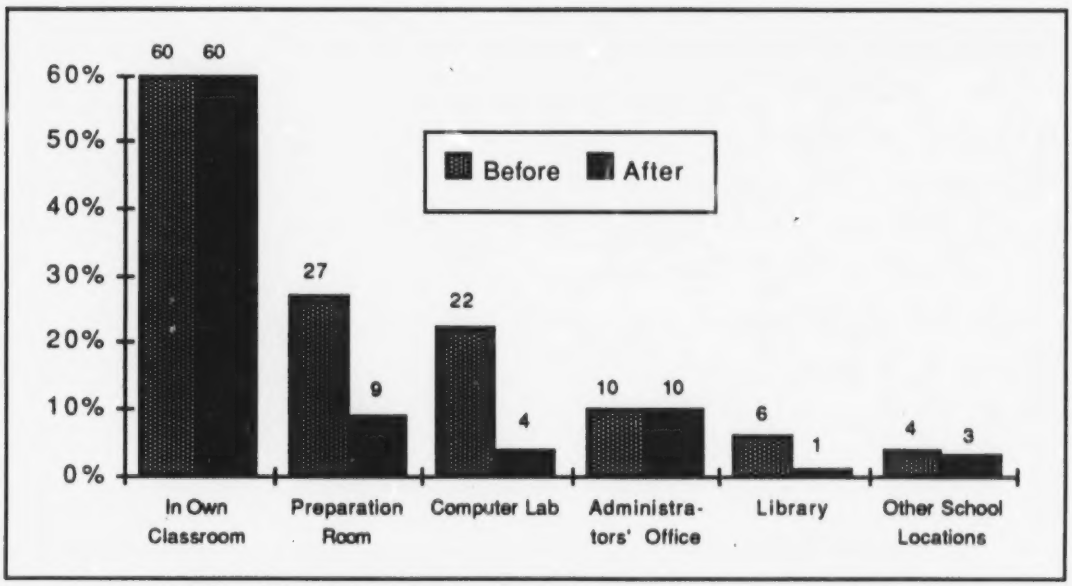
On issues of computer phobia (whether they thought computers were frightening and hard to learn), most educators became less phobic in general, but still had some trepidation. This was most evident in one of the high schools. The staff had gone from having computer labs only in the business education program to having several large computer labs for all students to use in their new building. All students were now required to take a full year of computer literacy and, while the students had become computer literate, not all of the teachers were equivalently up to speed. While teachers were learning, many felt, nevertheless, that they were still not as adept as the students.

- **Staff computer use**

Educators who had used computers before the project started, if only with a little experience, tended to do word processing, record keeping, and developing student materials. Most of these educators were teachers who owned their own computers; a few were teachers who used a computer in school for record keeping or word processing.

The figure below illustrates where participating teachers and administrators were using computers. Note that many teachers who were using computers before the project began used available computers in prep rooms and in the school's computer lab; after two years, these teachers were using computers at home and thus, didn't need to use computers in different school locations.

Figure 1
Location of Computers Used
Before and After the Program Started*

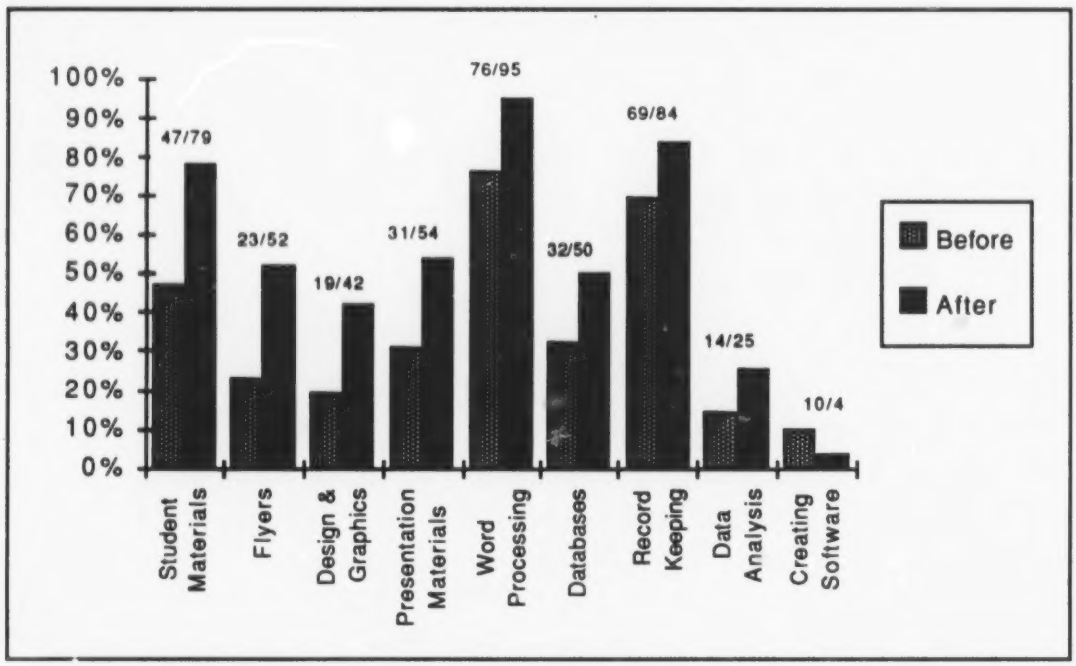


*Before data from teachers using computers, N=99, after from all teachers, N=114; more than one response was permitted.

When we sent the first questionnaire to participating teachers and administrators, we asked them to indicate what they expected to use their computer to accomplish. Almost every teacher reported that it would be used primarily for grade and record keeping (91 percent). More than one-third (38 percent) thought they would use it for creating classroom materials or making

up tests (35 percent), and 30 percent thought that they would use their computer for correspondence and for creating newsletters. From the data below, in Figure 2, school staff members report on how they used computers in school to accomplish their work. It seems that they did a lot more development of classroom materials than they had initially expected. A look at Figure 8, later in this section, shows how these expectations fared.

Figure 2
Computer Use in School by Participating Staff
Before and After the Program Started*



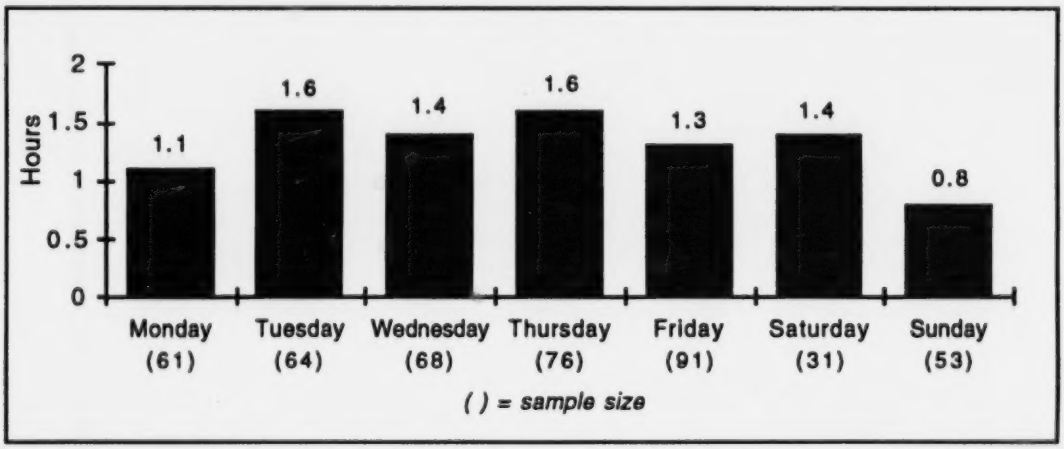
*Before data of teachers using computers, N=103, after from all teachers, N=117.

The dramatic increases occurred in those areas in which public documents were being created. There were more word processing and record keeping — these functions were necessary and demanded; but the use of computers for creating materials that would be seen by students, parents, administrators, and

other teachers is the area where computer use seemed to show the most proportionate growth.

We gave computer-use diaries to all participating staff in May, 1992. For four randomly selected days over a two week period, each person was asked to indicate what he or she did with computers and the length of each computer-based activity. The diary forms included Saturday and Sunday and no day of the week was duplicated on an individual's form. This information, along with interview and questionnaire data, captures how these educators were actually using their computers. Of approximately 140 people receiving diary forms, 111 returned them; only two of those people did not use the computer during the four days on their form. Thus, we estimate that more than 98 percent of the school staff used computers over four randomly-selected days.

Figure 3
Amount of computer use per day for all participants, whether they used the computer or not on a given day



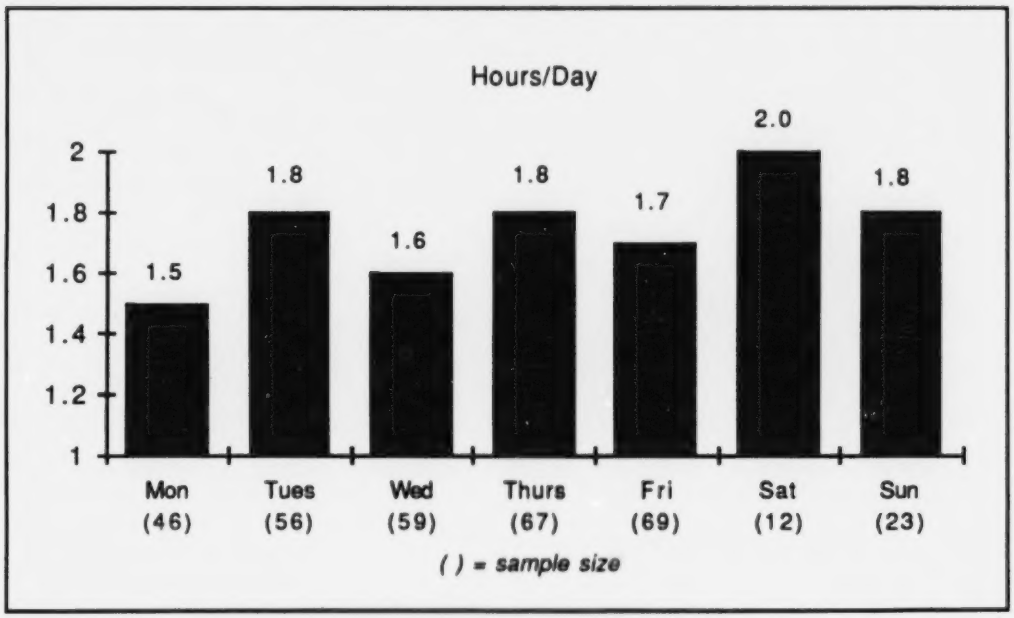
While the number of people using computers on any given day varied, given the random selection of days, there was proportionately more computer use during the school week than during the weekend. Over the entire set of

responses (diary forms with a specific day, whether the computer was actually used or not), educators used computers for an average of approximately one hour and twenty minutes per day, or more than nine hours per week.

Elementary school staff used their computers for an average of one hour per day for the sampled week, while the high schools' staff used their computers for approximately one and a half hours per day. Vocational and industrial arts teachers tended to use a computer for more hours per day (1.7) than teachers in any other subject matter speciality, and while administrators used the computer more each day (1.8 hours) than did classroom teachers (1.2 hours per day).

Figure 4

Amount of computer use per day for only those participants actually using the computer on the selected day



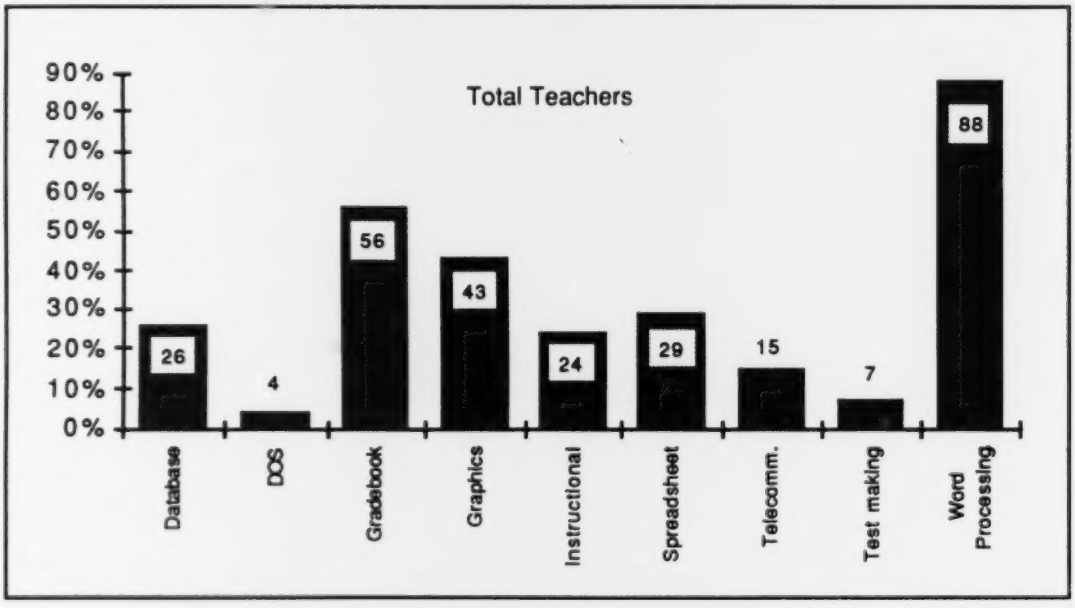
When we look at the amount of computer use each day for only those people who actually used the computer that day, we get a better sense of how much time and effort were spent on computer-based activities. From Figure 4, opposite page, note the variability of use during the week. For instance, for those teachers who were using the computer on Saturday, the average amount of use was a little more than two hours, whereas for Sunday, it was one hour and forty-five minutes. Computer use during the school week ranged from about 75 to 88 percent of the school staff. About 40 percent of them used their computers during the weekend. However, while not many teachers used their computers over the weekend — 12 on Saturday and 23 on Sunday — those who did put in a significant amount of time.

Well, what did these teachers and administrators do with their computers? How did they use them? In the discussion below, we will focus mainly on the classroom teachers in our analysis, but we will also describe some of the differences noted for administrators. The sample size for teachers is 94; for administrators (including computer coordinators, counselors, and librarians, as well as site-level administrators), the sample is 17.

An analysis of what the computer-using teachers actually did with their computers over the sampling period (Figure 5) indicates that 88 percent of the people used word processing software and that application consumed about forty percent of the time they used the computer. Given word processing as the substantial application, there were other significant uses made of the computer. In Figures 5 and 6, below, you can see that more than half of the teachers used a gradebook program and more than forty percent used graphics software. Moreover, much of the time spent on the computer, about a third of the total, included work on gradebook, database software, and instructional software.

Note the percentage of time that went into instructional software in Figure 6. From the interview data, we discovered that those teachers who assigned computer-based instruction to their students spent a great deal of their time reviewing software before assigning it. This would account for the significant proportion of time spent on that category of software.

Figure 5
Teachers' Use of Software During Sample Period

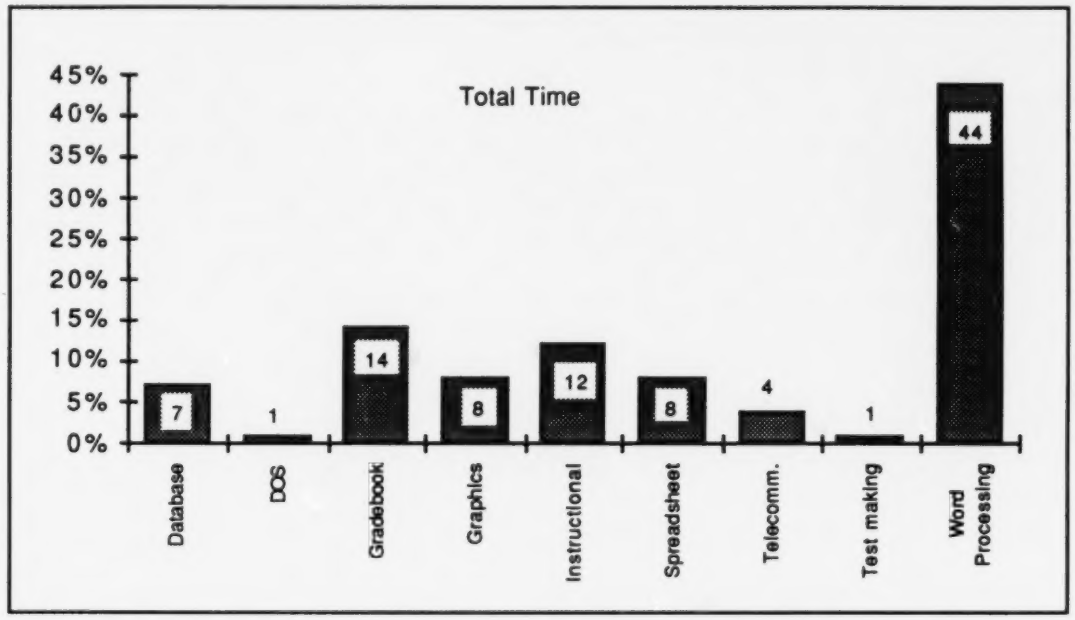


As one might expect, about sixty percent of the administrators used a database program whereas only 26 percent of classroom teachers did, and most of them used it for calculating grades. In contrast, very few administrators used a gradebook program, whereas most of the teachers did.

When we looked at the data in Figures 5 and 6 and analyzed the use of software by the subjects teachers taught, we found some interesting patterns. For instance, fine arts teachers used database and spreadsheet software quite

often, since they have the responsibility for ordering and maintaining large amounts of supplies and equipment. As might be expected, elementary teachers and those responsible for special education used instructional software more often than other instructional staff. In addition, the elementary teachers were the most frequent users of telecommunications, since modems were ordered with their computers. Only a few of the other teachers had modems.

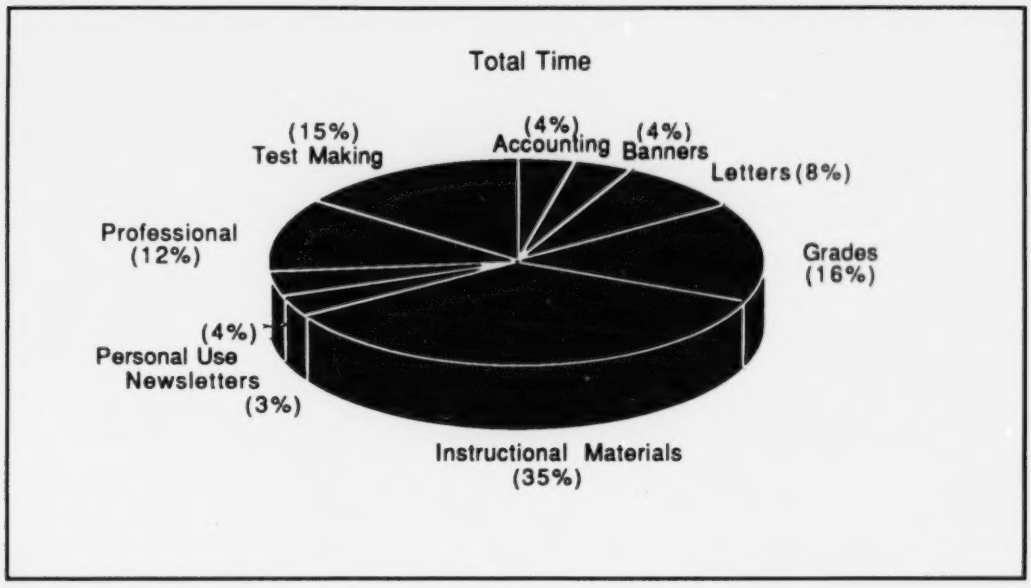
Figure 6
Teacher Time Spent on Software During Sample Period



In addition to software used, we asked the participants to indicate the functions for which they were using their computer. Not all computer use was covered by these categories, but a substantial amount could be accounted for; see Figures 7 and 8, below. Most of the instructional staff was involved in developing instructional materials, making tests, and formulating grades, for more than 60 percent of the time they used the computer. Only 10 percent of the teachers used the computer to create newsletters during the sample period.

Here, too, we noted that administrative staff tended to use their computers for different functions than did the instructional staff. Administrators tended to use computers for accounting (41 percent), correspondence (76 percent), and professional activities (71 percent) to a much greater degree than did classroom teachers.

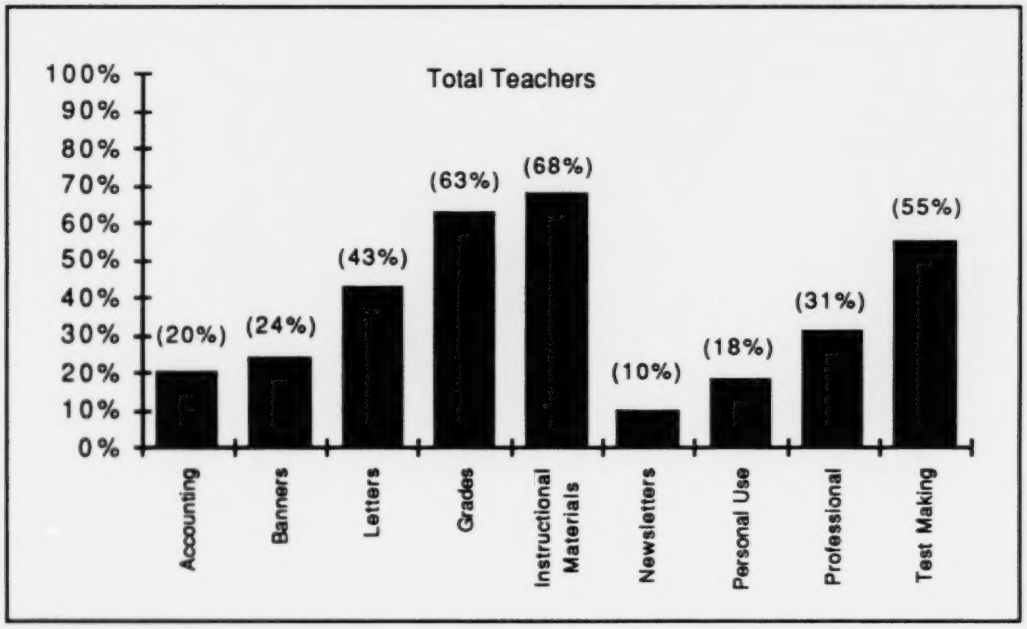
Figure 7
Functions Served by Computer Software by Time Spent



Additionally, we looked at the data in Figures 7 and 8, and analyzed the functions of computers according to the subjects teachers taught. Fine arts teachers used the accounting software and conducted more correspondence than other teachers, consistent with their use of consumables. Almost all language arts teachers (90 percent) and most social studies teachers (75 percent) used the computer for test making. Interestingly, fewer than half of the mathematics and science teachers used the computer for test making, suggesting that they do not possess specialized software for mathematical and scientific notation. Forty percent of the elementary school teachers created

newsletters on the computer during the sampling period; they, more than secondary school teachers, provide feedback for parents. These data are supported by the interviews we conducted in the schools.

Figure 8
Functions Served by Computer Software by Teachers

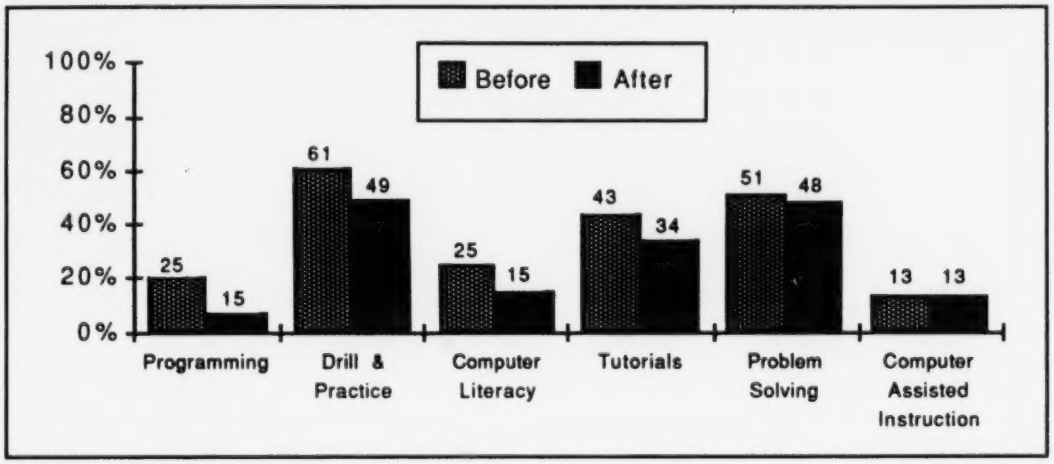


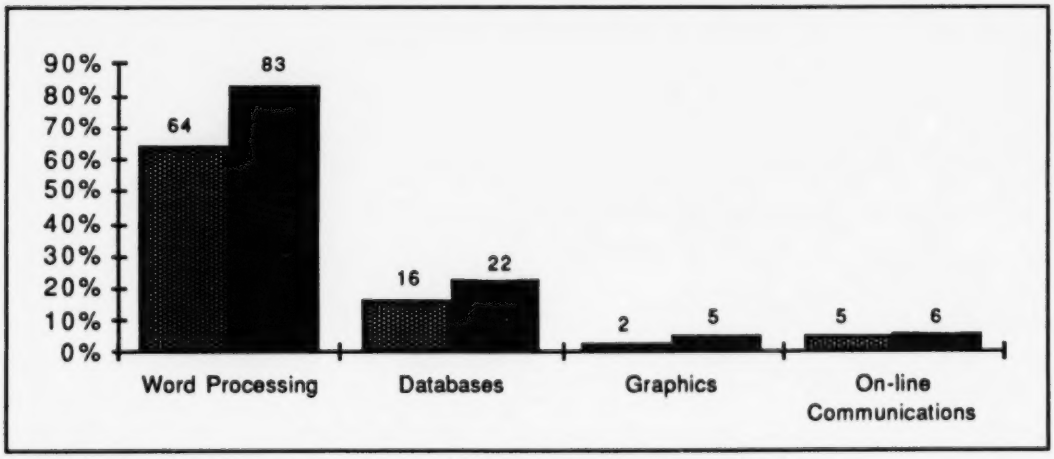
- **Student computer use**

We asked teachers how their students had used computers. About two-thirds of the teachers reported that their students had been using the school's computers for various reasons, both before the program started and two years later. We divided the data into categories of use that were emphasized by the *A Computer for Every Teacher* program, and those that were not. The data in Figure 9, below, indicate the influence of the program on student computer use. While teachers reported that the application of computers for enrichment barely changed, and instructional applications increased slightly over the two

years, the use of computers for remediation was reduced by nearly half. Teachers who now knew how to use computers had apparently re-thought how technology should be applied for instruction and did not see the same value in remedial work as they had before. When we looked at the actual applications students use, the teachers' own skill development seemed to have

Figure 9
Computer Applications for Students
Before and After Program Started*





*N= 84 before and 80 two years after; multiple responses were permitted.

a substantial effect on their students' assignments. Figure 9 is divided into two parts: The first displays computer assignments that students had traditionally done; the second, displays those applications for which the staff had received specific instruction.

Prior to the start of the project, 70 percent of the teachers who used computers assigned students to use computers; in contrast, only 4 percent of the initial non-users encouraged their students to use computers. After the program had been in effect for two years, 86 percent of those who had used computers before made student assignments, and so did 50 percent of the previous non-users. By learning more about the computer and what it could do, teachers were more prepared and able to ask their students to use technology for schoolwork; they could make productive assignments rather than less meaningful seatwork.

- **Home computer use**

Among the participants, 63 (44%) reported using a computer at home prior to the project, and 52 (83%) of those people used that computer for their professional work, although most of them reported using the computer only infrequently. Almost all of the computers were Apple II or DOS-based systems and were used by children at home almost as much as they were by the parent.

After the project began, 29 percent of the educators bought a computer; for some, it was a second or third, but for most, it was the first computer they owned. This computer was also available to them at home, if they chose to leave the project's computer at school. At the end of two years, every teacher who had a computer at home was using it; 108 people reported having one there. Some of these were personally owned computers, while others were the school's.

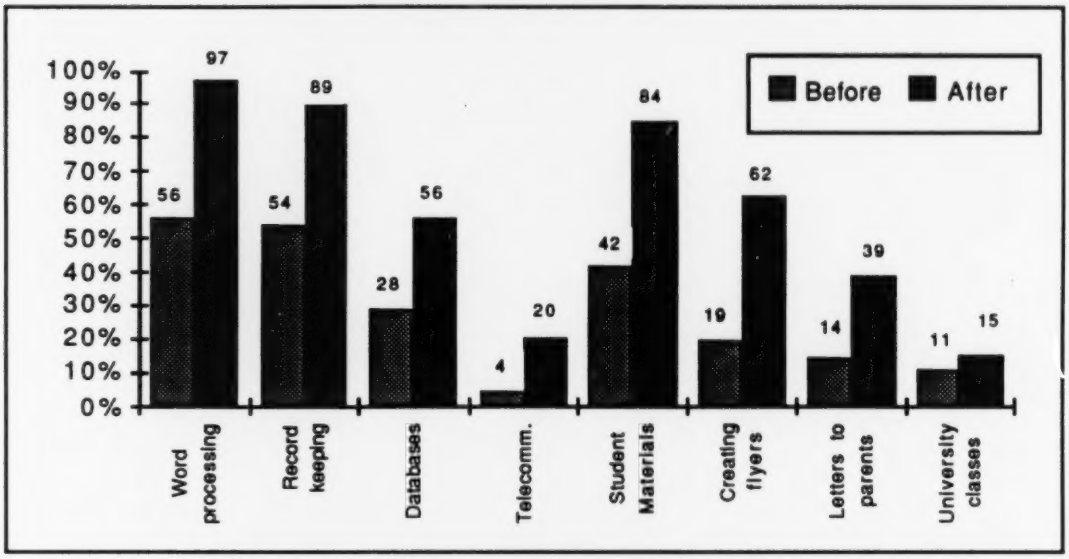
Whether teachers kept their computer at home or at school varied with the culture of the school and teachers' access to other computers in each location. Some schools encouraged keeping the project's computers at school, especially at sites where few computers were generally available for faculty use. Other, more generously equipped sites did not overtly encourage teachers to maintain their computers in the classroom so teachers kept them at home. Only a few teachers reported regularly transporting their computers from home to school and back again.

Two of the high schools were located in small towns, where faculty lived close to the school site and had easy access to the school building. Most of these teachers kept their computer in their classroom, for their personal and professional use and that of their students, too. Since many of the staff had keys to the building, they came in whenever they wanted to use their computers, in evenings and on weekends. For these teachers, school was as convenient as home for using the computer.

The applications used on these home computers changed from the beginning of the *A Computer for Every Teacher* program and began to closely approximate the uses made of computers in the school building by the staff. Computer applications for some activities doubled or more than doubled when computers, printers, and training were provided. A comparison of the data below with that in Figure 2, above, will indicate great similarities for the several similar categories.

While most of the out-of-school educational applications of computers were aimed at preparing instructional materials, many of the teachers in rural areas used their computers for activities which were associated with supplemental sources of income. Computers were used for farm accounting by many teachers; others had small businesses that required record keeping. Still

Figure 10
Computer Use at Home by Participating Staff
Before and After the Program Started*



*N=142 before and 117 two years after; multiple responses were permitted.

others used their computers at home for personal development, game playing, and for their children's instruction and entertainment. Annual Christmas letters, budgets for weddings and other family events, and personal correspondence were often mentioned by teachers and administrators as ways in which they used their computer. The computers were designed for teachers to use in any manner they deemed appropriate, and applying their emerging skills in non-school activities only served to improve those skills.

- **Applications and levels of use**

Teachers started with limited knowledge of technology and its application to personal and professional tasks. Over the course of two years, most teachers and administrators developed some proficiency with one or two applications and, while not masters of the software, they were able to use computers to accomplish many of their daily tasks. Word processing was the easiest to learn

and was the most widely used software. The basics of word processing were mastered and practiced almost daily by the majority of teachers. By the end of the second year, they were beginning to develop skills in complex formatting and were inserting graphics, charts, and tables into word processing documents. This was made easier by the common use of integrated software packages that each of the schools obtained with their computers. Heavy use was also made of clip art for graphics to enhance and enliven documents.

While much of the quantitative questionnaire and diary data about the use of computers has been reported above, there were other interesting patterns of use that emerged from the interviews we conducted with the participating school staff. These observations are not derived from isolated instances, but rather from the common elements seen at all of the schools. We report these observations below to complete the picture of technology use in those schools:

√ Differentiation and specialization emerged among the school faculties. Certain staff members were identified as specialists for certain pieces of software or for different functions within a program. For instance, in each school, teachers could readily identify whom to consult for answers to questions about using a spreadsheet or developing a database. In one school, a teacher had become the mail merge specialist, willing to share her skills with colleagues and the building administration. Specialities developed because the individuals had a specific need or a problem to be solved, and they decided to use the computer to satisfy that need. As a result, they had to delve more deeply into an application than did others at the school who were just receiving an overview of the application.

In some cases, these individuals had a greater knowledge of the application than did the computer coordinator.

√ Universally, high school athletic departments were reluctant to participate in training (because of conflicts with after-school coaching commitments) and staff members portrayed themselves as more limited users of the computer. However, they also recognized the power of the computer to accomplish many of the scoring and record keeping functions they required. While reluctant to admit their proficiency, at least one member of the athletic staff — or a competent student they instructed — was entering data and/or designing forms, stationery, spreadsheets, and data bases on the computer. Interestingly, they often mastered some of the most sophisticated applications software, such as spreadsheets, but did not feel comfortable with word processing. As a result, they felt as if they were not using their computers as effectively as others in their school building.

√ For most teachers, the computer was used to prepare instructional materials for classroom application. These materials ranged from assignment sheets to content handouts and worksheets to tests and other assessment forms. Teachers used graphics programs to illustrate text materials or to present diagrams useful for instruction. In addition, teachers prepared letters to parents, posters and flyers for special events, and even an instructional text/manual for a mathematics course.

√ Gradebook software was almost universally available and used by the vast majority of teachers. Several schools insisted on the use of computer-based grades and, as a result, a few recalcitrant teachers had to transfer grades from their handwritten gradebook to the computer forms before they could submit their student grade reports. They seemed to be motivated for a shift over, by the end of the second year.

√ Telecommunications was not universally available but, by the end of the second year, teachers and administrators were beginning to consider its

potential contribution to the schools. The grant had provided for modems, if desired, but not all schools took advantage of the opportunity. By the end of the second year, the school staff understood how connecting to each other electronically and to existing resources of information and professional assistance would be of value for improved management, productivity, and staff development. One school (elementary) had its students participate in an educational telecommunications project, and had its staff acquire modems with their computers. However, the small rural high schools found it difficult to accommodate the requirements of telecommunications, including such considerations as additional phone lines, the need to make long distance phone calls to connect to networks, open-ended purchase orders for long distance service, and other issues. Several of the teachers were enthusiastic enough to purchase modems for their own use at home and had connected to commercially-available services or to IDEAnet, the Indiana Department of Education's bulletin board and database service for schools.

IV. Range of Impact

Access to computers, printers, and staff development as part of the *A Computer for Every Teacher* program resulted in dramatic, observable changes in the instructional and administrative staff of each school. We identified individual changes, interpersonal changes, departmental level changes, and changes in the culture and atmosphere of entire schools. These impacts relate to issues of teacher productivity, teacher professionalism, instruction and school management, individual and institutional esteem, student learning, and technology in school.

The range of impacts of the *A Computer for Every Teacher* program speaks to the power of a simple, though not inexpensive, action. The effects were more pronounced for teachers, so their reactions are stressed in the discussion below. Nevertheless, impacts on administrators — and on the administrative functions of schools — were also strongly in evidence, as were impacts on student attitude and performance. We did not attempt to capture any statistical reports of improved learning as a direct result of this program.

- **On teacher productivity**

Teachers and administrators enthusiastically reported advances in personal and professional productivity. From the time it took to figure and refigure grades, to test development, to the creation of instructional materials — teachers reported significant improvements. They reported doing more, doing it faster, and doing it better with their computer. Many of the teachers we interviewed reported doing more in the same amount of time. That is, they spent the same amount of time on their administrative work and preparation for class, but they reported accomplishing much more in that time. Teachers produced more instructional materials for their classes, did more assessment,

provided more feedback to students, and handled their various extracurricular responsibilities more efficiently. As a result of these enhancements to their productivity, teachers reported greater confidence in their instructional ability.

As Table 2 indicates, teachers reported that they were more organized and did things faster after they received a computer to use in their work. The professional activities that changed the most were those in which they had received staff development on the computer and for which the computer is an appropriate and effective tool. On the other hand, the professional activities that changed the least were either those that were least emphasized in the training provided to participating teachers or that were not high priorities for these teachers regardless of technology.

Table 2
What Teachers Say They Do More
Now That They Have a Computer

Professional Activity	Percent Doing More
Access to more information	83
Do things faster	81
More organized	81
Keeping student records	75
Teaching materials	72
Tests/quizzes	72
Additional computer inservice	69
Letters to parents	62
Communicating with teachers/experts	58
Making presentations/speeches	43
Keeping track of expenses	41
Writing lesson plans	36

In addition to doing more, teachers also reported doing "better" work. Quality was defined as more effective and appealing instructional materials, enhanced communications, and more professional products. This quality also translated into more effective instruction. With a better "product" to use in the

classroom, teachers reported that their students received clearer instructions for assignments, did not have to struggle to decipher handwritten tests, and were more likely to complete forms and do homework worksheets. Furthermore, both students and teachers responded more favorably to flyers and printed announcements produced by the instructional staff for professional and extracurricular activities.

Collaboration among teachers was an additional aspect of productivity identified by many of the participating staff in each school. As specialization of computer skills emerged, teachers recognized that there was an instructional capability in-house. As a result they could inquire and get support to learn new software and new skills, and receive help to accomplish tasks with programs they did not know well. These collaborative activities also established new relationships among the faculties that resulted in more productive work settings. Several teachers reported collaboration on course development, on the development of common classroom procedures, and on reducing the time necessary to accomplish common administrative tasks. There was also increased participation in school activities by many faculty who had little interest or willingness to contribute before.

Enhanced productivity was a defined goal of *A Computer for Every Teacher*. From the perspective of teachers and administrators — and from the observations and data collected from these schools — enhanced productivity was the direct result of providing school staff with a computer, printer, and sufficient staff development to use these tools.

- **On teacher professionalism**

Teachers and administrators universally reported a better sense of professional competence as a result of mastering the computer. At a minimum, they can state they "now know as much as the kids." Placing

themselves on an even keel with their students reflects an important change in their perceptions of themselves as teachers. It is not a trivial outcome of the program; teachers have generally been reluctant to attempt new technology-based activities in the classroom for fear of being embarrassed or ridiculed by their students. With the skills and confidence they gained through this program, they see themselves as more professional in the eyes of their students.

Teachers' knowledge of what they could accomplish with computers encouraged them to have even greater expectations of themselves. They felt more confidence in their ability to accomplish more with their technology. This increased confidence had a spillover effect on their approach to teaching and learning. They felt better able to teach, given the quality of what they wanted to use — and did use — in their classrooms.

School faculty and administrators also reported producing more professional-looking materials for class use and for parent and community consumption. Going from handwritten, mimeographed materials for class handouts to multi-size, multi-font, illustrated, laser-printed instructional materials is a change indeed. Not only does it make teachers feel like professionals, but it reflects well on their school, they feel. Wherever we went for interviews, teachers and administrators would thrust examples of their work on us. They would often show us before-and-after examples, proudly pointing out how far they had come over the course of this project. Teachers noted that it was especially important to them to be able to write more professional-looking letters to parents and reports to administrators, as well as to provide other "public" documents that reflected their newly-learned skills.

Teachers also changed their perception of other teachers; their respect grew as they saw efforts expended, skills mastered, and success achieved. Several

teachers reported that they now saw other teachers who had been perceived as "nerds" as competent specialists in an area of computer use. They didn't have to like them more, but they did respect more and understood more about them. Thus, interpersonal respect grew as particular competencies became public knowledge. It worked the other way, too. As colleagues worked together in staff development programs, in seeking and providing assistance on software problems, they developed greater respect for each other's abilities. The non-intellectual was seen as having sufficient intelligence to master a piece of software, while the nerd was regarded in more human terms as others learned how he or she was using a computer to achieve professional outcomes.

Also, students gained respect for teachers as they saw the adults in the computer laboratory — learning a new piece of software or doing work not finished on their computer at home. Further, many students worked with their teachers to help them master aspects of software, becoming colleagues as well as students. More important for most students was the improvement in their teachers' instructional materials and products.

- **On instruction and school management**

There was little doubt in the minds of teachers and administrators that the availability and use of computers had made a difference in their classrooms and offices. New instructional materials were easier to create, modify, and individually adapt than they had been in the past, and many teachers took advantage of that capability. Teachers could provide clearer directions for class tasks and homework assignments; tests could be easily created and changed; worksheets could be developed and modified to individualize instruction.

For many teachers there was a need to learn to be a learner again. Teachers were placed in the roles of students and became more aware of what students experienced when challenged to learn new skills. They did not report feeling

humbled; rather, they saw how good instruction can make a difference in learning. The experience caused many teachers to reassess their own teaching and reconsider what it is they ask of their students. Several teachers said that they changed their instructional approach as a result of going through the training. Their revised pedagogy gave much more responsibility to students to be independent learners — because they saw from their learning experience that motivation and responsibility were effective strategies.

One of the important capabilities associated with having ready access to a computer for classroom management was provided by the gradebook software. In all of the high schools, giving and scoring quizzes was a regular, time-consuming activity; teachers felt that this was the only way to maintain a sense of how their students were doing. With the electronic gradebook, test scores could be quickly added to a student's record, and current grades quickly adjusted. This meant frequent assessment could turn into frequent and rapid feedback for students. This feedback, they felt, was vital to increasing student motivation, and even improving grades. Students had no excuse for not knowing how well they were doing in class and, as a result, they knew how hard they had to work to improve their class standing.

- **On individual and institutional esteem**

When a school was selected to participate in *A Computer for Every Teacher*, an immediate boost was given to school pride — and to community pride — from the status of winning a competitive grant. That pride was not universally felt until the computers and printers actually arrived and were passed out to the staff. To impress the school faculty with the relative enormity of the award, one of the coordinators put a price sticker with the full retail price on each package given out. Other staff did not celebrate the award until later in the school year, when they saw some of the impact of its implementation in their school.

For many, the grant was a head start in the "hi-tech" era for themselves and for their school. A small, isolated, rural high school could now claim to have a technology program few others in the nation could match. They, as teachers, were now as computer literate as one needed to be. As a result, they could take pride in the new educational and professional opportunities that lay ahead.

The award also served to bring the faculty together. School staff had to work together in in-service programs, help one another with the technology and software, and learn with other learners. There was an increased sense of being part of a special group. Moreover, once they had learned to use some of the software and produce "public documents" that were displayed on the walls and in the hallways of the school, they were additionally proud of the school and of public materials that portrayed the school. Flyers for the school play or bake sales, letters home, spreadsheets for the senior prom — concrete ways of displaying the new technological abilities were found throughout the schools. There were no longer only one or two members of the faculty and administration who were capable of producing high quality documents; almost all the staff were now capable.

Many of the staff, especially the coordinators, recognized new opportunities for seeking grants. The school had been successful in a highly competitive environment and was evidently a good candidate for other awards, as well. Individual teachers, as well as the school staff usually involved in grant-seeking, had written proposals during the first and second years of the program — proposals that they acknowledge would not have been written before they gained confidence in using computers. Not surprisingly, many of the proposals were for additional computers or computer software.

In addition to seeing opportunities for themselves and their schools, the participants also saw opportunities for using computers in novel ways within

the context of their academic or extracurricular responsibilities. The music teacher now wanted synthesizers, the art teacher, graphic tablets, the mathematics teacher, a teacher-created textbook.

- **On student learning**

As noted above, teachers acknowledged that they had improved the instructional materials they used in class as a result of having computers and printers accessible. Also noted were better tests, more control over grade information, and more frequent feedback and adjustments of student grades. All of these may be related to greater learning, although direct evidence is not available. Teachers were also more willing to let students use computers to accomplish school tasks and made more assignments to computer labs, where available. They saw the ways that computers had improved the classroom from their perspective and encouraged their students to enhance their learning through the use of computers, too.

As a result of improved productivity, teachers reported that time freed up from administrative tasks went into lesson development; their efforts went into substantive matters that improved instruction and learning materials. Numerous teachers reported more extensive planning efforts as a direct result of less time spent on grading and reporting grades to the school administration.

For several teachers, increased knowledge of computers and their application to instruction and learning helped both teachers and students. Teachers discussed collaborative learning opportunities with students, in which they would work with students to learn new software together. There were even some role reversals when students became teachers to help faculty members learn or enhance their skills on software. As a result of being placed in the roles of students, teachers developed new insight into the teaching/learning process. Sometimes that insight led to rethinking pedagogy

and modifying actions in the classroom. Such issues as wait-time, questioning styles, and independent learning were all mentioned by teachers at the schools as approaches they were now using as a result of being a student and trying to learn new, and often difficult, skills. The changes, they felt, resulted in improved instruction, and consequently, improved learning.

The faculty's new knowledge of the value and capabilities of computers also led many teachers to encourage students to use computers for class assignments and for other learning tasks. They now knew what to tell the students about computers and knew what computers could do for students individually and in the computer lab. As a result, they focused more on getting students to be more productive and successful using technology.

- **On technology use in school**

As a consequence of their initial mastery of computers, teachers reported that they were encouraged to attempt new technologies without fear of failure. They, and the technology coordinators, reported more use of television than in previous years, and more willingness to let students go to the school's computer lab or use classroom computers during free periods.

We created a technology-use index, consisting of the set of technologies that might be available in the school. We thought that more experience with computers might lead to differences in using other technologies. This index dropped from 5.8 to 5.2 in the two years after staff had received their computers. It appears that, after receiving computers, teachers cut back on the number of other technologies they used, especially filmstrips. There were a few inter-school differences, and the technology-use index varied with the subjects taught. Elementary teachers and vocational education teachers used many different media for their instruction, while fine arts and math and science teachers used fewer.

Table 3
Number of Media Used by Subject Area*

Vo-ed (6.6)	Language (5.8)
Elementary (6.5)	Fine arts (4.8)
Social studies (6.0)	Math and science (4.6)

*VCR, camcorder, overhead projector, videodisc, film, filmstrip, computer, etc.

Prior to the beginning of the project, more than half of the staff members (58 percent) who used computers had made a request for a computer during the previous year; of non-users, only 18 percent had made such a request. As Table 4, below, indicates, these early users were also much more likely to have requested new software than were non-users. Two years after the program began, when everyone now had a computer to use either at home or at school, 41 percent of the teachers and administrators placed a request for more computers during the previous school year, and 57 percent had requested more software. Either they wished to keep their computer at home and have another to use at work, or they wanted computers for their students to use in class. When it came to training, before the project began, 50 percent of those who already used computers had requested training and 22 percent of non-users had also. Two years later, 61 percent of the participants requested training during the school year.

Table 4
Percent of Staff Making Requests

	Before		After
	Users	Non-users	All Users
Request Computers	58	18	41
Request Software	79	25	57
Request Training	50	22	61

After learning some computer skills, teachers now recognized they needed more staff development time to learn even more. It may be that these

educators were more aware of the potential of the computer, and had sufficient knowledge to now specify and request what they needed. In addition, having had a taste of using the computer themselves, they now had a desire to obtain more resources for themselves and their students.

We also created a "requester index" to get a sense of how pervasive the demands were. (Did educators request one, two, or three of the elements: computers, software, and/or training?) There was no difference in absolute number of requests from before the project began and two years later. We found that more experienced users requested more things, while less experienced users may not have even known what to request.

In interviews, many teachers said they had asked for more computers for themselves and for students and wanted more software, especially curriculum materials for integrating the computer in their classroom instruction. For several of the staff, their widespread introduction of computers had raised their expectations for multimedia and CD-ROM. They had been unaware of such possibilities before, but with experience came the desire to explore. Many teachers also mentioned an expectation to network computers in their school and to use telecommunications to get outside the boundaries of the school building.

Both teachers and administrators noted an initial belief that technology would depersonalize their educational environment; this was especially worrisome in the small, rural schools. They found, to the contrary, that technology allowed for increased interpersonal activities. People spent more time in colleague-to-colleague and teacher-to-student relationships on, about, and with their computers. The computer became the focus of discussions with colleagues and with students.

V. Issues and Lessons

When a school applied for an award to provide every professional staff member with a computer system, the project coordinators were aware that the road ahead would be filled with decisions, with barriers and opportunities, and with the potential to make a difference in their school. The road was not smooth, but each participating school was able to develop and implement its program effectively. There were certain issues that helped or hindered that effort and, from an understanding of these issues, we can derive some lessons about the value and implications of *A Computer for Every Teacher.*

- **Leadership**

There were common leadership elements in each of the schools. An administrator or teacher led the effort, initially, by managing the application process and obtaining the consent of the school staff for their full participation. Next, these leaders, or the project coordinator who became the new champion, took responsibility for implementing the project (e.g., arranging for staff development, trouble shooting for the equipment, etc.). These champions continued their oversight and management efforts during the summer months and into the second year by providing additional help, materials and equipment, as well as staff development opportunities. The project coordinators sought out new software for teachers and encouraged them to experiment.

Further, each school also had upper management-level support, with both building administrators and school board members providing encouragement and often further financial backing. The knowledge that they were doing something perceived as important sustained the project coordinators through periods of difficulty, times when they had to face reluctant colleagues or deal

with technical issues that could not be easily overcome. All were perceived by the school faculty and administration to be agents of change in their own schools. All had high energy levels, were willing to try new things, and were cheerleaders for change and for technology. All had the respect of their colleagues for their endurance, accomplishments and skills.

Three of the coordinators had strong technical skills (or were willing to master new programs as necessary) and were seen as technical resources as well as cheerleaders and project coordinators. The fourth had a managerial role that centered on implementation of technology for learning and libraries and, while very knowledgeable about the nature and value of new technologies, turned to others for in-depth information about software and equipment.

All of the participating schools had elements of the effective schools philosophy in place. It was easy to identify the safe environment and high expectations; there were clear instructional goals and large amounts of feedback for student work. These were successful schools in many ways, even before the project began.

- **Single versus multiple platforms**

Schools were able to select one or more computer systems for their staff. In each case where multiple platforms existed, in two of the four schools, there was little cross-pollination among the staff. Teachers and administrators formed "in-groups" that sometimes turned out to be competitive, in a positive fashion, with each group of loyalists vying with the other for successful applications. The Macintosh ease-of-use made a difference, with little time spent in learning the operating system, in contrast to the longer learning period experienced by those with MS-DOS machines. None of the software selected by schools was platform specific, but the learning time was significantly different, depending on the choice of computer.

In the elementary school, a group of teachers, many with small children at home, selected the Apple IIGS. Given the school's Apple II lab, this meant these teachers had access to many of the schools' software programs for use in their classrooms or at home, wherever they kept their computer.

In a few instances, some teachers later were sorry about their computer choice, because of learning time and because of social pressure. In most of these cases, teachers felt they should have selected a Macintosh because of its ease-of-learning and its graphics capabilities.

Some of the experienced users would have been upset if their personal favorite had not been available to them. This was especially true for Macintosh and IBM-compatible users, but not for Apple IIe users, even though the Apple IIe computer was the most frequently-used home computer prior to the project. It seems that low-power users with low-power machines were willing to grow, but that people with higher level computers wanted to stay with their choice, regardless of what others chose.

With two platforms in a school building, there were greater costs for software and staff development; schools had to double the amount of in-service and had two site licenses to purchase. The cost of maintenance was also higher and dealer contact took substantially more time, resulting in greater administrative costs. There was a significant trade-off to maintaining two platforms, but it resulted in staff satisfaction.

- **Staff development**

The initial training was poorly done; the staff included many people with limited, if any, experience with computers and the instructional content included large numbers of programs, including HyperCard. With little learner analysis done prior to the opening session, both the instructors and the

participants were ill-informed. This was the first instruction in computers many of the teachers had received, and it was too advanced for most participants, who were not ready for the level of discussion. For most of the schools, the timing of the initial instruction was poor. It took place just as school was beginning, and teachers had little time to think about their new computer opportunities as they were trying to get ready for the school year.

Many participants experienced the problem that instruction was given for large chunks of material with little time for them to absorb and practice what they had learned. Staff would have preferred — and benefited more from — shorter, more frequent training periods in order to practice and obtain feedback. To master the elements of most pieces of software required many hours of after-school exploration and practice. Most were willing to put in the time and effort, but felt the need for more effective instructional strategies.

The better instruction came during the second year, after all the staff had had some experience using a variety of software and had decided what they wanted to learn. Locally obtained — and especially locally provided — training seemed to work better. In-house capacity was the best, since it provided staff with the opportunity to regularly revisit and ask questions of the instructor. Furthermore, knowing what they wanted — and what they didn't want — meant that the staff could help manage their own in-service, slowing it down or speeding it up, depending on their needs and abilities.

- **Additional lessons**

The experience gained in this project is worth sharing — for further implementation of this or other efforts to use computers widely in schools. The lessons were not gained without some discomfort, and the difficulties need to be acknowledged along with the successes.

√ Financial match

This project required each school to provide some of the funds for the hardware. This approach was powerful and valued. The equipment should be seen as an investment, and school ownership comes when someone signs a check. Schools needed to consider the opportunity cost in deciding whether to participate in this program. The school must want this project; local investments make the school more serious. Opportunity cost analysis may also lead the school to invest further in technology.

However, the schools needed more advanced notice in order to budget effectively and efficiently for matching funds. Often they had to "steal" funds from one or another budget source to make the match. Coordinators also recommended paying stipends for professional time, as had been done for this project, where the Department of Education provided funding for substitutes and/or afterschool time. It is an investment in people and is perceived as such by the staff. Don't ask teachers to contribute their time; treat them as you would any professional.

√ Single platform

It seemed most effective to select a single platform, regardless of computer choice, but to select one with high growth potential. The more sophisticated users were easily able to go from one platform to another, but the least experienced needed the consistency and a sense of belonging that came from a single selection.

√ Keyboarding

For those participants who had low typing skills — many more than expected — more training in keyboarding was necessary. These novices were a problem in group training sessions; they kept the class back and, in learning new applications, they were more reluctant users.

√ Group activities

As a means of attaining solidarity and increasing motivation among the staff, schools used such strategies as teacheres unpacking the computers together or noting the retail price of the equipment they were receiving in order to let them know how fortunate they were — these kinds of efforts made a big difference. Further, they provided major public relations opportunities for the local press. The project was visible and newsworthy, resulting in pictures in the paper, reports made to public forums, etc.

In addition, a great deal of solidarity among the staff was gained by perceiving the group of participating educators as members of the new workforce, workers who were capable of using appropriate technology to reach their teaching and learning goals. In this project, they were state-equipped new workers.

√ Work groups

Staff development was effective when participants worked as a group at first, then broke into smaller groups based on skill level later. Getting started together helped build group sensibility and cohesion. Coordinators recommended promoting ownership with project gifts and tee shirts and other items that help form a group with an identity.

√ Requirements

Requiring the involvement of EVERYBODY is central to the success of the program, and the EVERYBODY should include administrators and support staff. No one was left out and no one could escape. Schools had different degrees of implicit demands of staff to attend and participate. The approach worked better with a strong hand; the reluctant became participants when it was clear that they were required to play. The non-users do not need a means of escape, and the probability that they learn may surprise them.

√ Distributed skill development

Participants needed to develop skills on one piece of software before jumping to the next. Many felt lost initially, with too many things to remember and too little time to learn the minimum necessary to produce anything. They also wanted smaller chunks of training with some time for practice (and resource help to follow up) before moving on to the next lesson. Novices thought it better to master the machine before learning software, so that the computer doesn't get in the way of learning. They also recommended teaching the same thing more than once; they felt they needed repetition and reinforcement.

Often successful staff development required staff members to produce a product on their computers and bring it back to show others. A show-and-share program served as a veiled assignment and a way to have teachers cross departmental barriers and focus on learning computer skills, not subject-specific applications. Good instruction, in this case, meant a transfer of skills from teacher to teacher. However, it required both curriculum integration to overcome subject matter barriers and communication focused on the computer application and not the subject matter. All four schools tried this approach, to some extent, and some started earlier than others. Coordinators had to be careful not to provide too much, too fast, or too early.

√ In-house capacity

In-house people who know their learners and are close to them are likely to be the best instructors for staff development. They can pick up on laggards and help them get up to speed before the next group session. They are always available for consultations, as well.

√ Timing

Staff development activities needed to begin earlier in the summer to give

the staff a head start. Schools that waited until teacher prep days immediately before the start of school were at a slight disadvantage because the teachers were preoccupied with the new school year.

√ Realistic expectations

Staff should reduce their expectations, especially concerning the rate of learning and their ability to learn multiple sets of software right away. Further, while a high level of motivation might be expected in an innovative effort, it cannot be counted on.

VI. Next Steps

This project can be seen as a first step in introducing technology as a productivity tool for teachers and administrators in schools throughout Indiana. In preparation for state or local school districts to undertake implementation efforts, we would like to propose a set of strategic considerations. These approaches are designed to facilitate effective applications of technology or to offer tactics that will lead to successful actions. There are opportunities to expand the technology programs within the participating schools and to begin to enhance the productivity of other schools by providing their teachers with computers.

- **A growth plan**

A technology growth path and planning effort at building, district, and state levels could start with some of the participating schools in this program. One strategy to extend the schools' technology program may be carried out through the following set of activities:

√ Providing more technology in the schools for students to use.
√ Adding newer technologies for teaching and learning.
√ Disseminating findings to other schools within a district to model the program.
√ Making presentations throughout the state, using building or district funds for educators to attend conferences.
√ Creating an implementation handbook and inservice training program for others who wish to attempt similar efforts.
√ Building a network and leadership cadre for professional collaboration and the teaching of in-service courses.
√ Assuring repair and replacement dollars as the program grows.
√ Continuing to monitor and quantify progress in the use of technology.

This plan can be implemented, in part, through the existing resources of the four participating schools and the enthusiasm and good will of the site

coordinators. Assistance from the Indiana Department of Education would be valued, nevertheless. While continued support for *A Computer for Every Teacher* is not within the scope of the current Department of Education budget, the schools themselves can continue modest support. The Department should consider a modest coordination and communications role for itself.

• Integrating technology in curriculum

Integrating computers into the curriculum is the next logical step for the participating schools. In discussing the acquisition and implementation of computers with school staff, we saw a thoughtful progression from personal computer use to curriculum integration. Teachers, who now felt comfortable with computers for their own productivity, wished to have instructional materials for their subject-based instruction. This application of technology requires more software for teacher and student use, software that has a curriculum focus. It also entails more staff development, for the teachers are not always certain that they know how to use computer software as one of their curriculum tools. This new thrust toward integrating technology in the curriculum was exemplified by greater interest in CD-ROM and multimedia materials and more interest in new pieces of software for subject matter areas.

Teachers are willing to broaden their instructional capabilties with computers and provide a richer learning opportunity for their students. They see ways of extending what they do in classrooms with software they have seen at conferences, read about in professional journals, and have been told about by the computer coordinator. Technology may be the precursor of a redesign of the curriculum or the impetus for changing the school structure.

• Telecommunications

Telecommunications offers interesting opportunities for staff development, and for the management of schools. Many — certainly not all —

of the teachers and administrators with whom we discussed telecommunications said that they would like to make connections with others in their profession, whether in seeking information from experts, in expanding their access to information through statewide networks, and in gaining access to data bases through commercial services. However, they saw barriers to getting modems and software, as well as difficulties in achieving access to phones. There was also the issue of dealing with the cost of the phone lines. Nevertheless, teachers also saw the value of communicating from school to home and from home to school. They wanted to be able to discuss instructional projects, participate in school-wide planning, and manage school activities with other teachers during out-of-school time. In addition, they recognized the potential in sharing lesson plans with substitutes and with administrators when home sick. Teachers also saw opportunities for students to expand their horizons from their small communities to the larger world using telecommunications. However, while many of the participants were familiar with IDEAnet, only a few, even among those with modems, had signed on.

- **Continued staff development and support**

While most of the teachers and administrators in the participating schools had made great progress as computer users, they still recognized that they had a long way to go before becoming experts. Additional staff development activities would be useful to most of the teachers, especially if they could help define the specific learning needs they had. Schools should also be encouraged to publish the names and skills of their in-house experts — both students and teachers — so that others are aware that they can get help in their building and so that those who have developed particular skills can receive recognition.

Because this is a teacher-centered activity, when teachers transfer to other public schools in the state, they should be able to take their computers with

them, if they choose. The personal computer has become one of their professional and instructional tools. Losing it would damage their productivity as teachers and classroom managers. At the same time, any new teachers in a participating school should be provided with a computer, a printer, and a fixed amount of in-service resources that can be spent locally. This opportunity would make new teachers the equals of their colleagues and result in parity within the school. Each school should identify a mentoring team to help newer teachers adjust to the system. Schools should provide a stipend for those teachers helping newcomers; this work is a professional service and should be remunerated.

- **Widening the program**

If this project is a pilot for larger efforts in the state, it may be stated that it was successful within the context of small rural and suburban schools. The evidence is substantial and overwhelming that teachers became more productive, more professional, and produced higher quality work as a result of the program. However, the project needs to be tried with larger schools in inner city or suburban areas. Also, it needs to be tried with less well-endowed elementary schools. We believe a second phase would be beneficial before enormous amounts of state and local resources are spent on expanding this program. However, that should not prevent the state from publicizing the outcomes from this study in order to encourage wealthier school districts to spend their own money on similar programs.

- **Full versus partial implementation**

While the initial effort of *A Computer for Every Teacher* was at a school site level, the cost of implementing this project in a large urban secondary school may seem prohibitive. This research leads us recommend providing computers, printers and staff development for all professional personnel within a school building. The nature of a common task within the framework

of a common building or self-defined unit seems to be one of the keys to success. If support is not available for an entire school to participate, educators should consider implementing this project for entire departments. For instance, in a large high school, the groups of teachers receiving equipment and training should be as completely contained and contiguous as possible in order to place pressure on the faculty for full participation and collaborative efforts. Given the isolation of teachers, in general, a program like this can enhance cohesiveness and collegiality among teachers in big, urban schools.

There is no question that introducing computer-based productivity within a department is better than not challenging the faculty at all, but the public relations value, the positive changes to the school culture, economies of scale, and the equity of computer access are significantly enhanced when the entire school participates at once.

- **Learning from the research and disseminating results**

Schools around the state should learn about the implementation and successes of *A Computer for Every Teacher*. An aggressive dissemination effort should be mounted, engaging the services of the school site coordinators, state department staff, and even the researchers. The Department of Education should provide financial support for site coordinators to attend teacher and administrator conferences throughout the state to speak about the program. Those willing and able to write articles should place them in both educational publications and general interest magazines in order to garner support for the acquisition of computers and other technologies for local schools.

Further dissemination should be made through testimony to legislative bodies — both state and local. Knowledge of the power of technology to enhance teacher productivity is a strong argument in support of initiating or further developing technology programs.

In conclusion, this research effort has shown that *A Computer For Every Teacher* was a successful project, supported by state and local funds to increase the productivity and performance of teachers and administrators. We believe it is worth replicating wherever and whenever the resources are available.

Appendix:

I.	Participants	A1
II.	1990 Questionnaire	A3
III.	1992 Questionnaire	A7
IV.	Diary Form	A11

A Computer for Every Teacher

Participating Schools and Contacts

Roz Eiler
Rossville Jr. & Sr. High School
Rossville IN 46065

Gail Luedtke
North Judson-San Pierre High School
900 Campbell Street
North Judson IN 46366

Cheryl Muller
Haverhill Elementary School
4725 Weatherside Run
Ft. Wayne IN 46802

Sister Rebecca Abel
Forest Park Jr. & Sr. High School
RR3, Box 326
Ferdinand IN 47532

1990 Questionnaire

About your use of technology — in-school and out.

This questionnaire is designed to gather information about your use of technology and your perception of its value to you and your professional activities. We ask for your name so that we can coordinate the information on this form with other forms that we will use over the next months. We will not be reporting individual data, only information aggregated by school or by subject taught, or other attributes that help us understand how teachers, collectively, use technology. Thank you for your help.

❒ ✍ ❒

Name _____ School _____

Grade(s) taught _____ Subject(s) taught _____

Years teaching ____ Academic credits: BA+___credits; MA+__credits; other_____

Credentials/certification in: _____

About your use of technology in school (prior to July 1, 1990).

Did you use a computer in school to accomplish your work? yes ❒ no ❒

Was this the school's computer or was yours? school's ❒ mine ❒
Was the computer in your classroom? yes ❒ no ❒
In a teacher preparation room? yes ❒ no ❒
Other places? _____

For how many years have you used a computer in school for:
student learning ____ for your own work ___

If you did use a computer in school, did you use it for: (Check as many as apply.)

writing/word processing ❒ record keeping ❒ data bases ❒ design ❒
preparing student materials ❒ presentation materials ❒ creating flyers ❒
data analysis ❒ creating software ❒ other _____

Did you request that your school or department purchase computers during the past year? yes ❒ no ❒

Did you request that your school or department purchase software during the past year? yes ❒ no ❒

Did you request that your school or department provide training on computers during the past year? yes ❒ no ❒

Which other technologies did you use in your teaching?
VCR ❒ camcorder ❒ overhead ❒ videodisk ❒ film/filmstrip ❒
other _____

(please continue)

A3

About your students' use of computers.

Did you assign your students to computers to do their work? yes ❒ no ❒

On computers in your classroom? ❒ In a computer laboratory? ❒
In another teacher's room? ❒ Other places? _____

What kinds of work did your students do on computers? (Check as many as apply.)

drill & practice ❒ tutorials ❒ problem solving ❒ programming ❒
computer literacy ❒ data bases ❒ writing/word processing ❒
computer-assisted instruction (CAI) ❒ on-line communications ❒

Was their use of computers for :
enrichment ❒ remediation ❒ regular instruction ❒

Did some of your students use computers on their own for class assignments?
yes ❒ no ❒

Is that good ❒ bad ❒ makes no difference ❒

Do you encourage your students to use computers? yes ❒ no ❒

About your preparation.

Have you had an undergraduate class on computers or instructional technology (that included computers)? yes ❒ no ❒

Have you had an graduate-level class on computers or instructional technology (that included computers)? yes ❒ no ❒

Have you had inservice classes on using computers in education? yes ❒ no ❒
Please describe each class: length, topics, how long ago, etc.

Have you taken classes on your own to learn about computers? yes ❒ no ❒
Please describe the class: from whom, length, topics, how long ago, etc.

(please continue)

About your use of technology at home (before July 1, 1990).

Did you have a computer in your home? yes ❒ no ❒ (If no, skip to next section)

What brand/model is it? _____

Who uses the computer? you? ❒ spouse? ❒ child(ren)? ❒

How much is it used?

almost every day ❒ | several times a week ❒ | once a week ❒ | once a month ❒ | not at all ❒

If you use a computer at home, is it for your professional work? yes ❒ no ❒

What do you use it for? word processing ❒ record keeping ❒ data bases ❒
telecommunications ❒ creating flyers ❒ preparing student materials ❒
correspondence with parents ❒ university classes ❒

How much do you use the computer at home?

almost every day ❒ | several times a week ❒ | once a week ❒ | once a month ❒ | not at all ❒

For how many years have you used it? _____

Do you have a VCR at home? yes ❒ no ❒ Do you set the timer? yes ❒ no ❒

What do you think about computers?	agree						disagree
Computers can improve student learning.	❒	❒	❒	❒	❒	❒	❒
Computers can help me do my work.	❒	❒	❒	❒	❒	❒	❒
Computers are a little frightening.	❒	❒	❒	❒	❒	❒	❒
I'm excited about learning to use a computer.	❒	❒	❒	❒	❒	❒	❒
Computers will change school curriculum.	❒	❒	❒	❒	❒	❒	❒
Everyone needs to learn to use computers.	❒	❒	❒	❒	❒	❒	❒
I will be able to do more using a computer.	❒	❒	❒	❒	❒	❒	❒
Computers make teaching easier.	❒	❒	❒	❒	❒	❒	❒
Computers are hard to learn.	❒	❒	❒	❒	❒	❒	❒
Computers will change education.	❒	❒	❒	❒	❒	❒	❒
The quality of my work will improve with computers.	❒	❒	❒	❒	❒	❒	❒

(please continue)

What do you think?

How do you expect to use computers for your school work?

How do you expect your students to use computers for their school work?

What do you hope to learn about using computers during this year?

In what ways do you think your teaching will be different after you have a computer at home?

What aspects of your school work will change when you have a computer at home?

	more	less	same
writing lesson plans	❒	❒	❒
letters to parents	❒	❒	❒
teaching materials	❒	❒	❒
tests/quizzes	❒	❒	❒
communicating with other teachers/experts	❒	❒	❒
keeping student records	❒	❒	❒
do things faster	❒	❒	❒
more organized	❒	❒	❒
access to more information	❒	❒	❒
keeping track of expenses	❒	❒	❒
making presentations/speeches	❒	❒	❒
take additional inservice computer classes	❒	❒	❒

(Thank you.)

A Computer for Every Teacher
About your use of technology — in-school and out.

This questionnaire is designed to gather information about your current use of technology. We ask for your name so we can coordinate this information with other data we have gathered. We will not be reporting individual data, only information aggregated by school or subject taught, or other attributes that help us understand how teachers, collectively, use technology. Thanks for your help.

Name _____ School _____

Grade(s) taught _____ Subject(s) taught _____

About your use of technology in school this year:

Do you use a computer in school to accomplish your work? yes ❒ no ❒

Is this a school computer or yours (from the program)? school's ❒ mine ❒
Is the computer in your classroom? yes ❒ no ❒
In a teacher preparation room? yes ❒ no ❒
Other places? _____

Do you use a computer for: (Check as many as apply.)

writing/word processing ❒ record keeping ❒ data bases ❒ design ❒
preparing student materials ❒ presentation materials ❒ creating flyers ❒
data analysis ❒ creating software ❒ other _____

Did you request that your school or department purchase computers during the past year? yes ❒ no ❒

Did you request that your school or department purchase software during the past year? yes ❒ no ❒

Did you request that your school or department provide additional training on computers during the past year? yes ❒ no ❒

Which other technologies did you use in your teaching?
VCR ❒ camcorder ❒ overhead ❒ videodisc ❒ film/filmstrip ❒
other _____

About your students' use of computers this year.

Did you assign your students to computers to do their work? yes ❒ no ❒

On computers in your classroom? ❒ In a computer laboratory? ❒
In another teacher's room? ❒ Other places? _____

(please continue) A7

What kinds of work did your students do on computers? (Check as many as apply.)

drill & practice ❒ tutorials ❒ problem solving ❒ programming ❒
computer literacy ❒ data bases ❒ writing/word processing ❒
computer-assisted instruction (CAI) ❒ on-line communications ❒

Was their use of computers for :
enrichment ❒ remediation ❒ regular instruction ❒

Did some of your students use computers on their own for class assignments?
yes ❒ no ❒

Is that good ❒ bad ❒ makes no difference ❒

Do you encourage your students to use computers? yes ❒ no ❒

Learning about computers this year :

Did you a formal, for-credit class on computers or instructional technology (that included computers)? yes ❒ no ❒

Did you take an inservice class on computers in education in addition to the ones provided by your school? yes ❒ no ❒
Please describe each class: length, topics, etc.

About your use of technology at home :

Did you buy another computer for use at home? yes ❒ no ❒

What brand/model is it? _____

What brand/model did you get in school?_____

Whether it is the school's computer or one you bought yourself:
Who uses the home computer? you? ❒ spouse? ❒ child(ren)? ❒
How much is it used?

almost every day ❒ | several times a week ❒ | once a week ❒ | once a month ❒ | not at all ❒

What do you use it for? word processing ❒ record keeping ❒ data bases ❒
telecommunications ❒ creating flyers ❒ preparing student materials ❒
correspondence with parents ❒ university classes ❒

How much do <u>you</u> use the computer at home?

almost every day ❒ | several times a week ❒ | once a week ❒ | once a month ❒ | not at all ❒

(please continue)

Do you have a VCR at home? yes ❒ no ❒ Do you personally set the timer to record a program? yes ❒ no ❒

What do you think about computers?

	agree						disagree
Computers can improve student learning.	❒	❒	❒	❒	❒	❒	❒
Computers help me do my work.	❒	❒	❒	❒	❒	❒	❒
Computers are a little frightening.	❒	❒	❒	❒	❒	❒	❒
I'm excited about using a computer.	❒	❒	❒	❒	❒	❒	❒
Computers change the school curriculum.	❒	❒	❒	❒	❒	❒	❒
Everyone needs to learn to use computers.	❒	❒	❒	❒	❒	❒	❒
I am able to do more using a computer.	❒	❒	❒	❒	❒	❒	❒
Computers make teaching easier.	❒	❒	❒	❒	❒	❒	❒
Computers are hard to learn.	❒	❒	❒	❒	❒	❒	❒
Computers will change education.	❒	❒	❒	❒	❒	❒	❒
The quality of my work has improved with computers.	❒	❒	❒	❒	❒	❒	❒

What aspects of your school work have changed since you received your computer?

	more	less	same
writing lesson plans	❒	❒	❒
letters to parents	❒	❒	❒
teaching materials	❒	❒	❒
tests/quizzes	❒	❒	❒
communicating with other teachers/experts	❒	❒	❒
keeping student records	❒	❒	❒
do things faster	❒	❒	❒
more organized	❒	❒	❒
access to more information	❒	❒	❒
keeping track of expenses	❒	❒	❒
making presentations/speeches	❒	❒	❒
take additional inservice computer classes	❒	❒	❒

If you have additional comments about using computers or about the A Computer for Every Teacher Program, please write them on the back page — but please check here, so we'll know to look. ❒

(Thank you very much.)

A9

A Computer for Every Teacher

Date: May ___ , 1992

Name _____ Grade/ Subject: _____

School _____

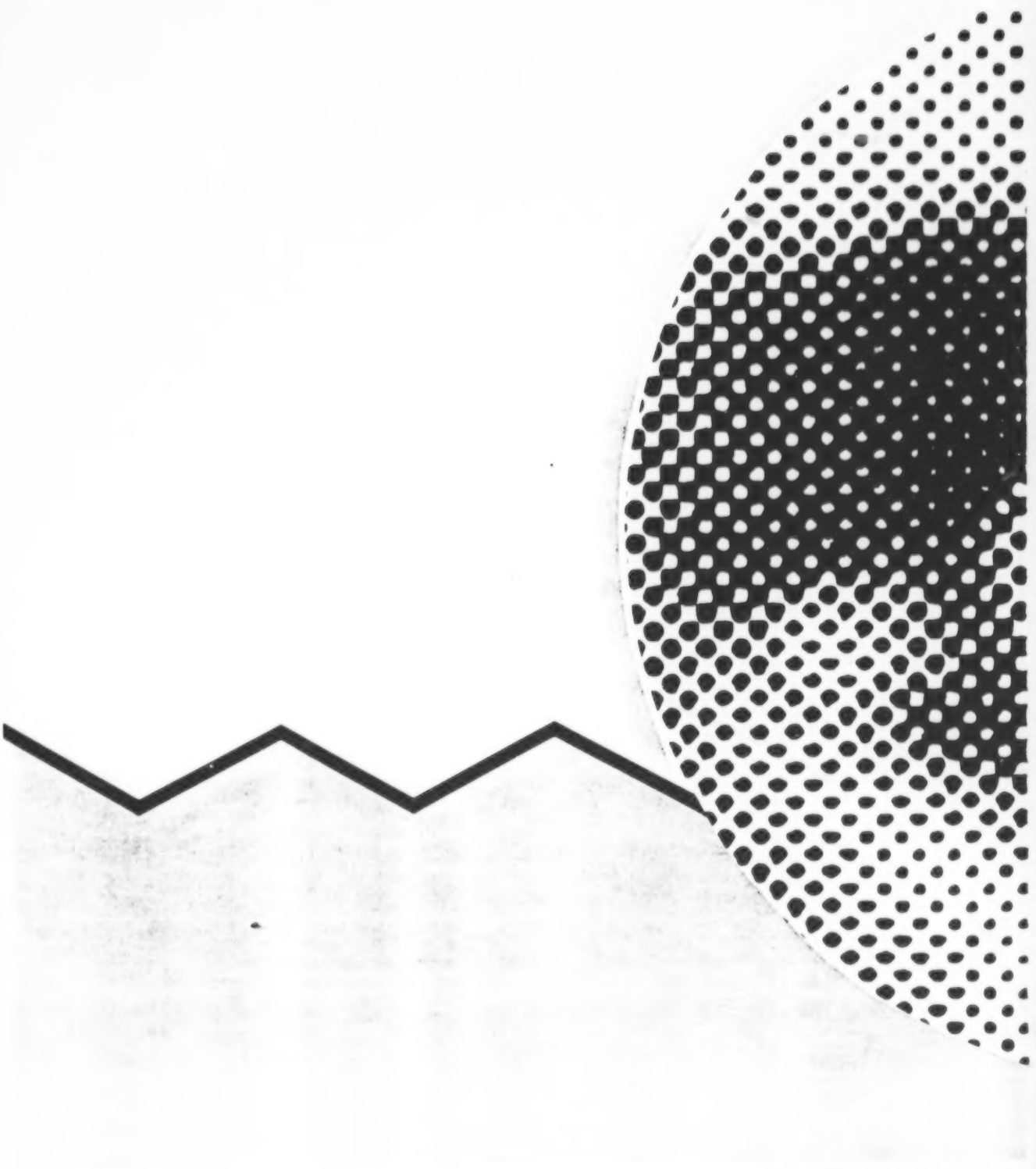
COMPUTER USE DIARY

Activities	Time (in minutes)	Task Accomplished/Software Used	Location I(n) or O(ut) of school*
Word Processing	___	_____	___
Database	___	_____	___
Spreadsheet	___	_____	___
Telecommunications	___	_____	___
Graphics	___	_____	___
Lesson Planning	___	_____	___
Instructional Materials	___	_____	___
Testing Materials	___	_____	___
Previewing Software	___	_____	___
Grades/Recordkeeping	___	_____	___
Budgeting/Accounting	___	_____	___
Electronic Mail	___	_____	___
Correspondence	___	_____	___
Other: _____	___	_____	___
_____	___	_____	___
_____	___	_____	___

* Where is the out-of-school computer located? _____

Please write additional comments about today's use of computers on the back of this page.
Please return this form to the project coordinator. Thank you.

A11



BEST COPY AVAILABLE